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Labor Regulations and the Informal Economy

Norman V. Loayza

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Summary findings

The informal economy, which evades labor regulations, provides employment for much of the labor force in developing countries. Loayza explores how labor regulations and imperfections in informal capital markets affect income inequality and the speed of industrialization.

Empirical evidence shows that labor costs are higher in the formal sector, and that the cost of capital is higher in the informal sector (in part because many informal activities are illegal, so contracts are unenforceable). Loayza develops a theoretical model based on such factor-cost asymmetry. He applies it to an urban economy with and without ample supplies of labor from the rural sector. The dynamic analysis considers rural-urban migration and optimal capital accumulation. His findings:

- Labor regulations that mandate workers' compensation above its market-dictated level induce the formation of an informal sector and thus the dispersion of wages across homogeneous workers. And labor regulations slow capital accumulation and retard the process of rural-urban migration.
- When capital allocation to informal producers becomes more efficient, the informal sector expands relative to the formal sector, the gap between formal and informal wages narrows, and rural-urban migration speeds up.
- Policies with an urban bias hasten rural-urban migration, inducing an expansion of the informal labor force relative to the total labor force.

Post–World War II experience in informal economies in Latin America motivates and in some respects supports the theoretical findings, says Loayza.

This paper — a product of the Macroeconomics and Growth Division, Policy Research Department — is part of a larger effort in the department to study the effects of regulation on inequality and economic growth. Copies of the paper are available free from the World Bank, 1818 H Street NW, Washington, DC 20433. Please contact Rebecca Martin, room N11-043, extension 39026 (46 pages). August 1994.

LABOR REGULATIONS AND THE INFORMAL ECONOMY

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I. INTRODUCTION

The formal sector is defined as the group of economic units that comply with regulations and taxes. By contrast, the informal sector evades onerous regulations but faces the disadvantages of working outside the legal system.

The informal economy, escaping labor regulations, provides employment to a considerable fraction of the labor force in developing countries. Turnham (1993) provides some estimates of informal labor employment for groups of countries at different stages of development. These are presented in Table 1. Informal employment declines in importance as the general level of development rises. However, it remains large even in high-income developing countries, in which it employs 31% of the labor force.

The present paper develops a theoretical model building over the asymmetry in factor costs evident in countries with informal economies: Whereas labor costs are higher in the formal sector, for the informal sector capital is more expensive. Regulations designed, in theory, to improve workers' welfare appear in various forms, namely, minimum wages, fringe benefits, social security, constraints on free hiring and dismissal, and protection to unions. Formal firms, because of their compliance with labor regulations, face higher labor costs. Portes, Castells, and Benton (1989) argue that "the best-known economic effect of the informalization process is to reduce the costs of labor substantially" (p. 30). Tokman (1992) writes that for small firms in Latin America, labor regulations augment labor costs by an average of around 20 percent, which is about equally divided between benefits and social security contributions. Sethuraman (1981), after reviewing a series of studies in developing nations, concludes that the majority of informal sector workers receive wages below the legal minimum. The observed wage dualism is not

explained by workers' skill differential across the two sectors; Fields (1990) writes that "both tabular presentations and multivariate analysis demonstrate wage differentials for observationally equivalent labor" (p. 51).

On the other hand, capital is more expensive to informal producers. Broadly speaking, this is due to capital market imperfections which are exacerbated by some features of informal firms, such as small size, low physical capital intensity, and semi-illegality. As explained below, the present paper abstracts from issues regarding firm's size of operation and derives low informal sector capital intensity as a result of the model. We argue that informal firms' semi-illegal status, brought about by their evasion of labor regulations, worsens capital market imperfections facing them. Given that informal activities are partially illegal, entrepreneurs can not exercise full property rights over them; therefore, contracts related to informal activities can not be properly enforced through the judicial system. The inability to sign fully enforceable contracts creates uncertainty and increases the transaction and monitoring costs in all business dealings conducted by informal firms. This applies especially to capital and financial markets. In his study of the Peruvian informal sector in 1985, De Soto (1989) reports that the average nominal borrowing rate for informal firms was 22% monthly, whereas for formal firms of comparable size, it was 4.9%. Huq and Sultan (1991) report that in Bangladesh informal firms paid rates between 48 to 100% annually for production loans, whereas the borrowing rate from commercial banks, for formal firms of similar characteristics, was around 12%.

The asymmetry in factor costs across formal and informal sectors provides the structure of this paper. We first analyze the static allocation of production factors across the two sectors that is consistent with a decentralized, full-employment equilibrium (Sections III.A and III.B). We then develop a dynamic model in which the urban labor force grows through a rural-urban

migration process, *à la* Harris and Todaro (1970), and capital accumulates according to an optimal program of savings and investment (Section III.C).

Section II briefly analyzes the Latin American context in which informal economies arose in the post-Second World War period. Section IV offers some suggestions for future research.

II. THE LATIN AMERICAN CONTEXT

In the post-Second World War years, Latin America experienced a remarkable demographic transformation. From 1950 to 1990, the proportion of the total population living in urban areas grew from about 40 to 70 percent. This tremendous expansion was mainly due to two factors. The first consisted of improved medical and sanitation conditions in the cities, which led to high birth and low death rates. The second, most important, factor was migration from rural areas. Table 2 presents some demographic indicators in Latin America. In Argentina, Chile, and Uruguay, which were already highly urbanized countries by 1950, urban population grew at a pace similar to that of developed countries and reached more than 85% of total population by 1990. In other countries the process of urbanization occurred notably quickly: Brazil, Colombia, Mexico, and Peru almost doubled their respective shares of urban population in 40 years. Only in El Salvador and Guatemala, urbanization was slow during this period (Portes and Schauffler (1993)).

Rural-urban migration occurred because living standards, employment opportunities, and general economic conditions improved steadily in the cities relative to the countryside. The last column of Table 2 reports the average of the ratio of capital investment to GDP for the period 1950 to 1985. For Latin America as a whole, it was 17.4%. By far, most of this investment

was allocated in the cities, thus creating jobs and better income opportunities in this areas. Interestingly, the lowest investment rates in the region are found in El Salvador and Guatemala, where urbanization was also sluggish.

Rural emigration was induced not only by capital formation in the cities but also by government policies that clearly favored urban over rural areas. Early in the post-Second World War period, the development strategy advocated by economists and followed by policy makers consisted of rapid urban industrialization. Urban-bias policies were gradually implemented to pull or push rural inhabitants to the cities to supply labor to the growing industrial sector. The UN Economic Commission for Latin America (ECLA) promoted the model of import substitution industrialization, which advocated, together with high tariff protection and heavy state investment, domestic terms of trade that favored industry over agriculture (Portes and Schauffler, p. 34). Latin American governments embarked on numerous public projects in the cities, including the construction and furnishing of schools and health facilities and the provision of electricity, water, and other utilities. Furthermore, roads and other means of transportation were improved or constructed to facilitate rural emigration to the cities (Williamson (1988)).

The disruption of international trade by World War I, the Great Depression, and World War II created dissatisfaction with *Laissez-faire* economic policy in Latin America. Populism and its associated movements responded to this discontent with strong state intervention in the economy. Several populists movements and leaders were formed in the Inter-War period, among them, Haya de la Torre and the American Popular Revolutionary Alliance (APRA) in Peru in the 1920's, and the Chilean Socialist Party in the 1930's; and in the 1940's, Juan Domingo Perón and the Peronist Party in Argentina, Jorge Eliécer Gaitán in Colombia, and Rómulo Betancourt and Democratic Action in Venezuela. These leaders, their followers, and/or their ideas attained

power in their respective countries at several points in the "heyday" of populism from the 1930's to the 1960's and less strongly in the 1970's and 1980's (Drake 1991).[1] Table 3 presents some populists episodes in Latin America during this period.

Populist policies sought to control the economy by means of direct intervention or regulations. Prominent among the latter were labor regulations. Cardoso and Helwege call minimum wage policies "the redistributive centerpiece of populism" (p. 68). Rather extensive labor legislation codes were enacted to purportedly further workers' welfare. These regulations, by effectively raising labor compensation above its market-dictated level, diminish the incentives for the industrial sector to provide work to the growing numbers of city inhabitants. Cardoso and Helwege conclude that "As the cornerstone of populist redistribution, minimum-wage increases promoted the welfare of relatively small groups at the expense of larger groups" (p. 62). As result of the state-induced excess labor supply in the cities, an informal sector, which evaded labor regulations, rose to give work to the masses of people for whom unemployment was not a viable option: "... informality represents the irruption of 'real' market forces in an economy straitjacketed by mercantilist regulation."[2]

The ILO's Regional Employment Program for Latin America and the Caribbean (whose Spanish acronym is PREALC) provides estimates of the urban informal labor force for virtually every country in Latin America. Given that most informal activities, *per se*, are not recorded in official statistics, measuring informal production and labor force is very difficult. Table 4 presents PREALC's estimates for 14 Latin American countries for the years 1960, 1970, 1980,

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[1]One exception to the waning of populism from the 1970's is the Alan García administration in Peru from 1985 to 1990, which almost brought the country to an economic and political collapse.

[2]Portes and Schauffler, p. 40, paraphrasing Hernando de Soto's view of informality in his book *The Other Path.*

and 1989. PREALC's estimation methodology presents serious shortcomings and inconsistencies, the most important of which is the exclusion of wage workers from early estimates.[3] For what is worth, Table 4 reveals a significant constancy of the proportion of urban informal workers over the last 3 decades, despite the tremendous changes, concerning industrialization and demographic transformation, experienced in Latin America.

The post-Second World War Latin American experience with informal economies motivates this study. Its purpose is to integrate and understand the relations between the most important features of the informal experience, namely, strong labor regulations, capital market imperfections, capital formation, and rural-urban migration. We want to understand the effects of labor regulations and informal capital market imperfections on income inequality, proxied in the model by the dispersion of urban wages, and the speed of industrialization, proxied by both capital accumulation and urbanization.

III. THE MODEL

A. THE ISOLATED URBAN ECONOMY

The urban economy is competitive and decentralized, with firms hiring production factors from their owners. All firms produce one good (Y), which can be equivalently used for consumption or investment. Firms share a basic production technology, which has the

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[3]PREALC's estimation strategy consists of identifying informal employment with entire occupational categories available from national censuses and household surveys. PREALC has consistently classified the self-employed -excluding professionals and technicians- and unremunerated family workers as informal workers. Only in early estimates, domestic servants were also included. In recent estimates (1989), owners and salaried workers of "small enterprises" (whose size definition changes from country to country) have been classified as informal workers. The exclusion of wage workers in early classifications introduced a strong downward bias in the estimates.

neoclassical characteristics (namely, constant returns to scale, decreasing returns to each factor, and the Inada conditions) and the property that production factors are complementary to each other. For simplicity we assume that the production function is Cobb-Douglas and that capital (K) and labor (L) are the only factors of production. Output production is then given by

$$Y = AK^{1-\alpha}L^{\alpha}, \qquad 0<\alpha<1 \tag{1}$$

Labor-market regulations are represented by the imposition of a minimum legal wage rate. Firms that obey the minimum wage legislation belong to the formal sector. Firms that ignore it belong to the informal sector. Firms cannot belong to both sectors at the same time.

The illegal status of informal firms makes contractual agreements more difficult and costly, especially in capital and financial markets. Because of additional monitoring and transaction costs, informal firms face a higher cost of capital than their formal counterparts. We model these (per-unit) additional capital costs as proportional to the market-determined net rental rate of capital. Capital owners receive the same net[4] rental rate from either sector and, thus, are indifferent between the two.

Formal and Informal Sectors in an Isolated Urban Economy

At a point in time, the aggregate levels of labor and capital in urban areas are given. This is so because in the case of an isolated urban economy both labor and capital grow gradually. The static solution consists of the market allocation of given urban aggregate labor and capital across the formal and informal sectors.

[4]Clearly, net of monitoring and transaction costs.

Profits for formal firm i are given by

$$\Pi_{F,i} = A K_{F,i}^{1-\alpha} L_{F,i}^{\alpha} - W L_{F,i} - R K_{F,i} \qquad (2)$$

where W is the minimum legal wage rate, and R is the market-determined net capital rental rate[5].

Profits for informal firm j are given by

$$\Pi_{I,j} = A K_{I,j}^{1-\alpha} L_{I,j}^{\alpha} - W_I L_{I,j} - \zeta R K_{I,j} \qquad (3)$$

where W_I is the market-determined informal wage, and the parameter ζ, $\zeta > 1$, is the factor of proportionality due to transaction and monitoring costs. This parameter measures the degree of inefficiency in capital allocation to informal firms.

Since the production technology is constant returns to scale, the size of firms in the economy is indeterminate. Firms in each sector choose the ratio of physical to human capital that maximizes their profits. There is one such ratio for all firms in the formal sector and another one for all firms in the informal sector. Because of this, in what follows we use subscripts to differentiate firms across sectors but not within each sector.

We now characterize the equilibrium situations for different levels of the minimum legal wage (W), *ceteris paribus*. There are three cases to be considered. First, the minimum legal wage is not binding so that only the formal sector exists. Second, the minimum legal wage is binding but not "too large" (as explained below) so that the formal and informal sectors coexist in

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[5]We normalize the factor of proportionality due to monitoring and transaction costs to 1 in the formal sector. Therefore, the capital rental rate paid by formal producers is equal to the net rental rate received by capital owners.

the economy. And third, the minimum legal wage is so large that the economy is completely informal.

First case: The minimum legal wage is not binding. In this case, the market wage with full employment in the formal sector is higher than the legal minimum. That is, since no worker will accept a wage lower than the market wage, **the whole economy is formal.** Profit maximization by firms, the zero-profit condition under perfect competition, and full-employment equilibrium determine the market wage rate (W_F) and the net capital rental rate (R):

$$W_F = MPL_F = A\alpha\left(\frac{K}{L}\right)^{1-\alpha}$$
$$R = MPK_F = A(1-\alpha)\left(\frac{K}{L}\right)^{-\alpha} \qquad (4)$$

where, MPL_F and MPK_F denote the marginal products of labor and capital, respectively, in the formal sector; and K/L is the urban aggregate capital-labor ratio.

Second case: The minimum legal wage is binding but not "too large." In this case the minimum legal wage is higher than the unregulated market wage[6]. That is,

$$W > W_{UNR} = A\alpha\left(\frac{K}{L}\right)^{1-\alpha} \qquad (5)$$

However, the minimum wage is not so high as to force the whole economy to be informal. In this case, under full-employment equilibrium, **the formal and the informal sectors**

[6]The unregulated market wage is the wage obtained in the absence of the minimum wage regulation.

coexist in the economy.

Profit maximization by firms, the zero-profit condition, and full-employment market clearing dictate the following equilibrium conditions. In the formal sector,

$$MPL_F = A\alpha\left(\frac{K_F}{L_F}\right)^{1-\alpha} = W \tag{6}$$

$$MPK_F = A(1-\alpha)\left(\frac{K_F}{L_F}\right)^{-\alpha} = R \tag{7}$$

And in the informal sector,

$$MPL_I = A\alpha\left(\frac{K_I}{L_I}\right)^{1-\alpha} = W_I \tag{8}$$

$$MPK_I = A(1-\alpha)\left(\frac{K_I}{L_I}\right)^{-\alpha} = \zeta R \tag{9}$$

The minimum legal wage rate plays a pivotal role in the determination of the net capital rental rate and the informal wage rate because it fixes the capital-labor ratio in the formal sector. From (6),

$$\frac{K_F}{L_F} = \left(\frac{W}{A\alpha}\right)^{\frac{1}{1-\alpha}} \tag{10}$$

Equation (10) shows that K_F/H_F depends positively on the minimum wage (W) and negatively on

the productivity parameter (A).[7]

We can express the net capital rental rate as a function of the minimum wage rate by substituting (10) into (7):

$$R = \left(A(1-\alpha)^{1-\alpha}\alpha^{\alpha}\right)^{\frac{1}{1-\alpha}} W^{\frac{-\alpha}{1-\alpha}} \tag{11}$$

Clearly, the net capital rental rate is negatively related to the minimum wage.

Given that the cost of capital in the informal sector is equal to a fixed proportion of that in the formal sector, the ratio K_I/L_I is a fraction of the ratio K_F/L_F. Dividing (9) by (7),

$$\gamma \equiv \frac{K_I/L_I}{K_F/L_F} = \zeta^{-\frac{1}{\alpha}} \tag{12}$$

Then,

$$\frac{K_I}{L_I} < \frac{K_F}{L_F} \tag{13}$$

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[7]Given that the minimum wage is binding, the inequality in equation (5) applies. Using the expression for K_F/L_F in equation (10) together with the inequality in (5), we find

$$\frac{K}{L} < \frac{K_F}{L_F}$$

The informal sector is less capital intensive than the formal sector[8] because the former faces a higher cost of capital.[9] Clearly, the relative informal capital intensity varies inversely with the parameter ζ.

Since K_I/L_I is determined by K_F/L_F, we can express the informal wage rate as a function of the minimum wage rate. Substituting (12) and (10) into (8),

$$W_I = \gamma^{1-\alpha} W \tag{14}$$

Clearly, the informal wage is lower than the legal minimum. This, of course, is consistent with the minimum wage being binding. The smaller wage in the informal sector is due to the sector's lower capital intensity. The informal wage increases with the legal minimum legal at a rate lower than one.

Full employment of production factors allows us to determine the actual quantities of formal and informal labor and capital. Using the definition of γ as the ratio of capital intensities in the two sectors (equation (12)), we can write

$$L_F = \gamma \frac{K_F}{K_I} L_I$$

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[8]Note that lower capital intensity in the informal sector is consistent with $K/L < K_F/L_F$ under conditions of full employment. In fact, since full employment means that $K = K_F + K_I$ and $L = L_F + L_I$, it follows from $K/L < K_F/L_F$ that

$$\frac{K_I}{L_I} < \frac{K}{L} < \frac{K_F}{L_F}$$

[9]Had we considered a more general specification for the additional capital costs faced by informal firms, a larger minimum wage would have reinforced the higher capital intensity in the formal sector.

Given that $K = K_F + K_I$ and $L = L_F + L_I$, and substituting the expression for K_F/L_F from equation (10), the above expression can be manipulated to obtain

$$L_F = \frac{-\gamma}{1-\gamma}L + \frac{1}{1-\gamma}\left(\frac{W}{A\alpha}\right)^{-\frac{1}{1-\alpha}}K$$

$$L_I = \frac{1}{1-\gamma}L - \frac{1}{1-\gamma}\left(\frac{W}{A\alpha}\right)^{-\frac{1}{1-\alpha}}K \tag{15}$$

Equation (15) provides expressions for L_F and L_I in terms of W, γ, and the urban aggregate levels of labor and capital. An analogous procedure would allow us to find expressions for K_F and K_I:

$$K_F = \frac{1}{1-\gamma}K - \frac{\gamma}{1-\gamma}\left(\frac{W}{A\alpha}\right)^{\frac{1}{1-\alpha}}L$$

$$K_I = \frac{-\gamma}{1-\gamma}K + \frac{\gamma}{1-\gamma}\left(\frac{W}{A\alpha}\right)^{\frac{1}{1-\alpha}}L \tag{16}$$

Equation (15) (or (16)) allows us to see how the coexistence of both sectors in the economy requires that, for given L and K, the legal minimum wage be in between two limiting values. The lower limit W' is the value at which the minimum wage is just binding. Then,

$$W' = A\alpha\left(\frac{K}{L}\right)^{1-\alpha} \tag{17}$$

Note, from equation (15), that when W is equal to W', L_F is equal to L (and K_F is equal to K). That is, at the lower limit W', the economy is still completely formal.

The upper limit W" is the value at and above which no firm can afford to pay the legal wage while paying the competitive rental rate of capital. In fact, when W is equal to W", L_F is equal to zero, and L_I is equal to L (also $K_F = 0$, $K_I = K$). That is, at the upper limit W", the economy starts to be completely informal. From equation (15), we can determine W":

$$W'' = \gamma^{-(1-\alpha)} A \alpha \left(\frac{K}{L}\right)^{1-\alpha} \tag{18}$$

Note that W" varies inversely with γ.

Equations (15) and (16) were developed under the conditions that create an equilibrium where both formal and informal firms are present in the urban economy. It is, therefore, not surprising that they make no sense when W is lower than W' or higher than W".

Let us examine how labor and capital in each sector respond to changes in the aggregate levels, for a given minimum legal wage.

Suppose that the minimum legal wage is fixed at some level. Also, suppose that aggregate capital is constant. Figure 1 graphs L_F and L_I as functions of L (for given K, W, γ) and K (for given L, W, γ). Let us focus on changes in urban aggregate labor (L). For small enough values of L, the minimum legal wage is not binding, and, therefore, L_F is equal to L; that is, all labor and capital are formal. As L increases beyond the threshold point L', L_F decreases, and therefore L_I rises faster than L. This continues until L is so large (relative to K, of course) that there is no longer an equilibrium in which L_F can be positive (from point L" on), and the whole economy is informal.

Consider only the region where both sectors coexist so that equation (15) applies. Given that the wage and rental rates are fixed by the minimum legal wage, when L or K change, the economy accommodates by adjusting the relative sizes of the two sectors. From (16), we can

calculate the partial derivatives of L_F and L_I with respect to L:

$$\frac{\partial L_F}{\partial L} = \frac{-\gamma}{1-\gamma} < 0 \qquad \frac{\partial L_I}{\partial L} = \frac{1}{1-\gamma} > 1 \tag{19}$$

Labor employed in the informal sector increases more than proportionately to the increase in urban aggregate labor, and, thus, formal labor decreases. This can be explained as follows: An increase in urban aggregate labor makes the minimum wage more restrictive, in the sense that it becomes further above the unregulated wage. This induces an expansion of the relative size of the informal sector. Given that aggregate capital is constant and the capital-labor ratio in the informal sector must remain unchanged, such expansion is attained through a shift of capital from the formal to the informal sector. Therefore, since the formal capital-labor ratio must also stay unchanged, formal labor decreases along with formal capital.

The effects of capital stock changes on the relative size of both sectors can be analyzed analogously.

Third case: The minimum legal wage is so high that all firms are informal. If the legal minimum wage is too high ($W > W''$), the equilibrium that allows formal and informal firms to coexist breaks down, and the only market-clearing solution is for all firms to be informal.

Profit maximization by firms, the zero-profit condition, and full employment equilibrium determine the market wage rate (W_I) and the net capital rental rate (R):

$$W_I = MPL_I = A\alpha\left(\frac{K}{L}\right)^{1-\alpha}$$

$$R = \frac{1}{\zeta}MPK_I = \frac{1}{\zeta}A(1-\alpha)\left(\frac{K}{L}\right)^{-\alpha} \qquad (20)$$

The informal wage is now the same as that when the economy is completely formal. This is so because now the informal wage is also dictated by the relative scarcities of urban aggregate capital and labor. However, the net rental rate of capital is now smaller because the additional transaction and monitoring costs decrease the value of capital.

Comparative Statics

We now present a graphical exposition of the wage and net capital rental rates, as well as relative[10] sector employment, in the three cases analyzed above. In the graphs, the subscript "UNR" is used to denote the unregulated wage and capital rental rates, that is, the competitive rates that will occur in the absence of a minimum legal wage.

Figure 2 shows the wage and net capital rental rates, as well as relative labor employment, as functions of the minimum legal wage, holding γ and K/L constant.[11]

Figure 3 allows the informal capital allocation efficiency parameter γ to vary, holding

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[10]Throughout this paper, "relative" employment refers to employment relative to total employment in the urban economy. For instance, relative informal labor is L_I/L.

[11]Figure 2 shows the informal wage not jumping when the economy becomes completely informal. That W_I is continuous at W" can be proven by substituting W" (equation (18)) into the formula for W_I when the two sectors coexist (equation (14)). By doing that, we obtain the same value for W_I as when the whole economy is informal (equation (20)).

By the same token, Figure 2 shows the net capital rental rate not jumping either when the economy moves from complete formality or when it becomes completely informal. Similar arguments as for W_I can be made to prove that R is continuous at both W' and W". Figure 3 implies a similar analysis.

K/L constant and W at a given binding level. Note that when the additional capital costs to informal producers are sufficiently low (that is, $\gamma \geq \gamma''$), the whole economy is informal.

Figure 4 allows the aggregate capital-labor ratio to vary, holding γ and W constant.

Conclusions and Policy implications (applied mainly to the mixed economy case)

1. The formal sector is more capital intensive than the aggregate economy, which in turn is more capital intensive than the informal sector.

2. When the minimum wage is increased because, for instance, government pursues populist policies to benefit the core of formal unions,

a. Although the informal wage increases, the gap between formal and informal wages widens.

b. The net capital rental rate decreases.

c. The informal sector expands and the formal sector shrinks.

3. When the additional capital costs to informal producers diminish because, for instance, capital subsidies are provided to informal firms or the informal sector develops a control and enforcement system that cuts down their transaction and monitoring costs,

a. The informal wage rises, and the gap between formal and informal wages narrows.

b. The informal capital rental rate decreases, approaching the net capital rental rate obtained when no minimum legal wage is imposed.

c. The informal sector expands and the formal sector shrinks.

4. As aggregate capital decreases relative to labor because, for instance, there is capital flight or labor immigration,

a. The relative size of the informal sector rises. If only one aggregate factor changes, we can predict the absolute size of either sector. For instance, when labor immigration occurs and the

capital stock remains constant, the absolute size of the informal sector rises whereas the absolute size of the formal sector shrinks.

b. The wage and rental rates remain unchanged, not reflecting the relative scarcities of production factors.

B. THE URBAN ECONOMY IN THE PRESENCE OF A RURAL SECTOR

Rural-Urban Migration Equilibrium

Assume that in rural areas the production technology does not require capital and is linear in labor (Lewis (1954)). That is,

$$Y_R = BL_R \tag{21}$$

In the absence of government intervention, the rural wage (W_R) is equal to the productivity parameter B.

There are no migration costs and there is complete turnover of workers in the formal and informal sectors.[12] Therefore, all workers face the same migration decision, which considers only **current** wage opportunities in urban and rural areas. The migration equilibrium condition we use resembles that introduced by Harris and Todaro (1970). Assume that workers are risk

[12]We relax the assumption of complete job turnover in the formal sector in Appendix A. We show that allowing for partial job turnover does not change the qualitative results presented in the text. Also, we show that the more accessible the formal sector to all workers, the higher the urban labor force and the relative size of the informal sector.

neutral.[13] Then, the migration equilibrium condition is given by

$$W_E - M = W_R \tag{22}$$

where, M represents the per-period wage adjustment due to different cost of living in the cities; and W_E is the urban expected wage. The assumption of complete job turnover in the cities implies that W_E is equal to a weighted average of formal and informal wages with the weights given, respectively, by the relative size of the each sector.

Given that we allow the possibility of immediate labor relocation across the two areas, the equilibrium condition in (22) must hold at all times.[14]

Urban Formal and Informal Sectors with Ample Supplies of Labor from Rural Areas

When in urban areas a binding, but not "too large," minimum legal wage is imposed, both formal and informal sectors arise in the economy.[15] The analysis presented in the previous section for the mixed economy case applies, under the conditions outlined below, in the presence of a rural sector. In particular, equations (6) to (16), which determine the informal wage and capital rental rates and the relative size of each sector, still hold true.

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[13]The Assumption of risk neutrality is not necessary for the analysis but is algebraically convenient for the purpose of comparative statics. We are not interested in describing the effects of risk aversion on migration decisions.

[14]In Harris and Todaro (1970), migration is a disequilibrium phenomenon. It occurs when the expected urban wage is higher than the rural wage. Implied in their analysis are migration costs that preclude the possibility of immediate relocation of labor from rural to urban areas (infinite migration rate). Therefore, in their model, the migration equilibrium condition is achieved only in the long run.

[15]The range of minimum legal wages that produce the coexistence of both sectors is given below.

As explained shortly, in the presence of a rural sector with ample supplies of labor, the level of the labor force in the cities is no longer autonomously given; it is in fact a function of the capital stock, the minimum wage, the additional capital costs to informal producers, and the adjusted rural wage. Therefore, equation (15), which determines the size of formal and informal sectors, must be rewritten to account for the dependence of the urban labor force on those other variables.

Using equations (14) and (15), we find that the average wage in urban areas is a linear function of the urban aggregate capital-labor ratio:

$$W_A = \frac{L_F}{L} W + \frac{L_I}{L} W_I$$

$$= \frac{\gamma^{1-\alpha} - \gamma}{1-\gamma} W + \frac{1-\gamma^{1-\alpha}}{1-\gamma} (A\alpha)^{\frac{1}{1-\alpha}} W^{\frac{-\alpha}{1-\alpha}} \frac{K}{L} \qquad (23)$$

$$= a_0(W,\gamma) + a_1(W,\gamma)\frac{K}{L}$$

Substituting the expression for the urban average wage into the migration equilibrium condition (equation (22)), we find

$$L = \left(\frac{a_1(W,\gamma)}{W_R + M - a_0(W,\gamma)} \right) K \qquad (24)$$

$$= g(W_R + M, W, \gamma)\ K$$

Equation (24) determines the size of the urban labor force that is consistent with migration equilibrium. The size of urban aggregate labor is increasing in the capital stock and

the efficiency of informal capital allocation (γ), and decreasing in the adjusted rural wage (W_R+M). Furthermore, the size of the urban labor force when the whole economy is formal is the same as when the economy is completely informal ($L(W \leq W') = L(W \geq W'')$). This is so because in both cases the urban wage equals the adjusted rural wage (as explained below). It can also be shown that the size of urban aggregate labor in those two cases is always greater than when the economy is partially informal.[16]

Substituting equation (24) into (15) we find the relative size of formal and informal labor employment in the presence of a rural sector:

$$\frac{L_F}{L} = \left(\frac{1}{1-\gamma^{1-\alpha}}\right)\left(\frac{W_R+M}{W} - \gamma^{1-\alpha}\right)$$

$$\frac{L_I}{L} = \left(\frac{1}{1-\gamma^{1-\alpha}}\right)\left(-\frac{W_R+M}{W} + 1\right) \qquad (25)$$

As expected, the relative size of the informal sector increases with the minimum legal wage (W) and the efficiency of informal capital allocation (γ), and decreases with the adjusted rural wage (W_R+M). The effects of changes in W, γ, and W_R+M on the absolute size of formal and informal sectors go in the same direction as the effects on their respective relative sizes. This is not obvious, as it was in the case of an isolated urban economy, because of the additional effects of those parameters on the urban labor force.

In order for the urban economy to present both formal and informal sectors, the minimum legal wage must be between the values W' and W". The lower limit W' is the value at which the

[16]In fact, the size of the urban labor force, *ceteris paribus*, first decreases, reaches a minimum, and then increases with W.

minimum wage is just binding ($L_F/L = 1$ in equation (25)):

$$W' = W_R + M \tag{26}$$

Note that W' is the unregulated urban wage in the presence of surplus labor from rural areas.

The upper limit W" is the value at which the economy just becomes completely informal ($L_F/L = 0$ in equation (25)):

$$W'' = \gamma^{-(1-\alpha)}(W_R + M) \tag{27}$$

Note that when W = W", the informal wage is equal to the adjusted rural wage ($W_I = W_R+M$), which, again, is the unregulated urban wage in the presence of surplus labor.

The graphical presentation used in the case of an isolated urban economy can also be applied here. The only change is that the unregulated rates, as well as the lower and upper limits W' and W", are now given in terms of the adjusted rural wage (W_R+M).

Conclusions and Policy Implications (applied mainly to the mixed-economy case)

1. Conclusions 1, 2, and 3 of the isolated-urban-economy case also apply here.

2. As aggregate capital decreases because, for instance, there is international capital flight or capital destruction,

a. The absolute size of the urban labor force, as well as both formal and informal labor employment, decreases.

b. The respective relative sizes of formal and informal labor remain the same.

3. The size of the urban labor force in the cities at any point in time is no longer autonomous

but varies directly with the capital stock and the efficiency of informal capital allocation, and inversely with the adjusted rural wage. Also, the size of the urban labor force in the absence of minimum wage regulations is greater than when they are imposed.

4. As the adjusted rural wage (W_R+M) decreases because, for instance, government follows an urban-bias policy through worsening the rural-urban terms of trade or improving public infrastructure and services in the cities,

a. The urban labor force rises.

b. The relative and absolute size of the informal sector expands.

C. DYNAMIC BEHAVIOR OF THE ECONOMY: CAPITAL ACCUMULATION AND RURAL-URBAN MIGRATION

The aggregate labor force and capital stock in urban areas change through time, thus affecting the size of the formal and informal sectors. The labor force in the cities expands by means of a rural-urban process of migration, and the capital stock grows according to a program of savings and investment.

Capital Accumulation

We assume that there are two different groups of individuals: Workers and capitalists. Workers supply labor inelastically and do not save or borrow.[17] Capitalists do not work but

[17]In reality this assumption means that workers' desired level of current consumption is higher than their wage. However, because of financial market imperfections, they are unable to obtain loans against their future higher income. Therefore, workers are constrained to consume only all their current wage. As we indicate later, given that we are abstracting from technological progress, workers' wage converge to a finite value. If such value is below their desired income and they are

rent out their capital to firms, and they save according to an optimal intertemporal program. These assumptions amount to a version of Kaldor's model of distribution (Kaldor (1956), Alesina and Rodrik (1991)).

Normalize the size of the group of capital owners to 1. Capitalists solve the following dynamic program:

$$Max \int_0^{\infty} e^{-\rho t} \ln(C(t))\, dt \tag{28}$$

subject to

$$\dot{K}(t) = R(t)K(t) - C(t) \tag{29}$$

where C represents instantaneous consumption by capitalists and ρ is the subjective rate of time preference. The capital depreciation rate is assumed to be zero. The assumption that the instantaneous utility function is logarithmic proves to be very convenient, as we show shortly.

Maximization of discounted intertemporal utility in (28) subject to the instantaneous budget constraint in (30) implies the following necessary and sufficient conditions:

$$\frac{\dot{C}(t)}{C(t)} = R(t) - \rho \tag{30}$$

$$\lim_{t \to \infty} K(t) e^{-\int_0^t R(v)\, dv} = 0 \tag{31}$$

---

unable to use financial markets, workers will never save or borrow.

Equation (30), the Euler equation, gives consumption growth as a function of the net capital rental rate. Equation (31), the transversality condition, ensures that not "too much" is saved.

The budget constraint, the Euler equation, and the transversality condition allow us to solve for the level of consumption as a function of the capital stock:

$$C(t) = \rho\ K(t) \tag{32}$$

The propensity to consume out of capital is equal to ρ, a constant.[18] Using the Euler equation, we obtain

$$\frac{\dot{K}(t)}{K(t)} = \frac{\dot{C}(t)}{C(t)} = R(t) - \rho \tag{33}$$

From previous sections we know that as long as the urban economy is mixed (formal/informal), the capital rental rate is determined by the minimum legal wage (W), as in equation (11). Given that we keep W fixed throughout this analysis, the capital rental rate is also

---

[18]Had we used a general constant relative risk aversion (CRRA) utility function, the level of consumption would also have been a linear function of the capital stock. However, the propensity to consume out of capital would not, in general, have been a constant but a function of the entire future path of capital rental rates. This would have complicated the analysis since the path of rental rates depends on whether and when the future economy is partially or completely formal, which in turn depends on the rate of capital accumulation. We conjecture that if the coefficient of relative risk aversion (θ) is lower than 1, there exists a unique equilibrium path for the capital stock. However, if $\theta > 1$, the trajectory of the capital stock will present multiple equilibria because of the feedback effect of the rate of migration on the rate of capital accumulation. This feedback effect works as follows: When a higher rate of migration occurs, rural areas are depopulated faster. After the rural sector is completely depopulated, the economy gradually becomes more formal. In a completely formal economy with capital accumulation, the rental rate gradually decreases. When $\theta > 1$, a lowering of the path of future rental rates leads to higher savings and capital accumulation. This in turn produces a higher rate of migration, and the feedback chain starts again.

fixed for as long as the economy is partially informal. Let's call this fixed level of the capital rental rate R_0.

We assume that capitalists are sufficiently "patient" so that $R_0 - \rho > 0$. Therefore, the economy's capital stock will grow at a constant rate for as long as the economy is partially informal.

Rural-Urban Migration as the Result of Capital Accumulation and a Gradually Implemented Urban-Bias Policy

The migration equilibrium condition in (24) establishes a relationship between capital accumulation and rural-urban migration. Taking logs and then time derivatives in (24), we find

$$\frac{\dot{L}}{L} = \frac{d\ln g(W_R+M,W,\gamma)}{dt} + \frac{\dot{K}}{K} \qquad (34)$$

$$= \phi(t) + \frac{\dot{K}}{K}$$

The labor force in the cities will grow faster than aggregate capital for as long as the function g(.) increases over time: $\phi(t) > 0$.[19]

The implementation of urban-bias policies can be represented in our model by an exogenously-induced increase in the function g(.), through a decrease of the rural wage (W_R) and the cost-of-living adjustment parameter (M).

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[19]In the text, we assume that the urban labor force grows only through immigration. If urban population grows autonomously (that is, through births and deaths) at the rate n_u, the rate of immigration m will be given by

$$m = \phi(t) + \frac{\dot{K}}{K} - n_u$$

There will be rural-urban migration as long as n_u is not too large.

Therefore, as long as the urban-bias policies are strengthened, the labor force in the cities grows faster than the capital stock.

Urban policies are eventually curved and made stable. When the rural wage and the cost-of-living adjustment remain stable, the model predicts that the urban labor force grows at the same rate as the capital stock.

Dynamic Behavior of the Economy

We can now integrate the results from the previous two sections with those from capital accumulation to characterize the dynamic behavior of the economy. We can describe three phases in terms of the relative size of the informal economy.

First Phase: Expansion of the Relative (and Absolute) Size of the Informal Sector. During this phase, urban-bias policies are gradually implemented: $\phi(t) > 0$. Since capital grows at a constant rate, the urban labor growth is given, from equation (34), by

$$\frac{\dot{L}(t)}{L(t)} = \phi(t) + R_0 - \rho \qquad \textbf{(34a)}$$

Clearly, the urban labor force grows faster than the capital stock. This decrease of the urban aggregate capital-labor ratio produces, from equation (15) (or (25)), an expansion of the informal labor force relative to the urban aggregate.[20]

Urban-bias policies are curved before the rural sector is completely depopulated. When both the rural wage and the cost-of-living adjustment are no longer decreased but kept stable, the economy enters its second phase.

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[20]We assume, however, that the economy remains mixed. This is true if the adjusted rural wage is not reduced too much (see equation (27)).

Second Phase: Stability of the Relative Size of the Informal Sector. When the adjusted rural wage is stable, the urban labor force grows at the same rate as the capital stock:

$$\frac{\dot{L}(t)}{L(t)} = R_0 - \rho \tag{34b}$$

As long as there are workers left in the rural sector, the urban capital-labor ratio remains constant in the face of capital accumulation. From equation (15) (or (25)), this implies that the relative size of the informal sector remains unchanged.

If autonomous population growth in rural areas is not very large, and given that the flow of migrants to the cities is rising[21] in this second phase, eventually, rural areas will be completely depopulated[22]. When this happens the economy enters its third phase. Note that the greater the pool of rural workers, the larger the phase in which the relative size of the informal sector is stable.

Third Phase: Contraction of the Relative (and Absolute) Size of the Informal Sector and the Emergence of a Purely Formal Economy. At the start of this phase the rural sector has disappeared; and therefore migration and, thus, urban labor-force expansion have come to a halt. Then, the analysis of the isolated urban economy (Section III.A) applies to this phase.

During the early periods, the formal and informal sectors coexist. The capital stock accumulates at the constant rate $R_0 - \rho$; therefore, the aggregate capital-labor ratio steadily increases. From equation (15), this implies that the relative (and absolute) size of the informal

---

[21]Clearly, the flow of migrants is given by

$$\dot{L}(t) = (R_0 - \rho)L(t)$$

[22]This is due, among other things, to the assumed rural linear technology. More realistically, if the rural wage increases fast enough as workers migrate to the cities, the rural sector will never be completely depopulated.

sector shrinks until it disappears completely when the minimum legal wage is just binding.[23]

When the economy is completely formal, capital accumulation produces a decrease of the capital rental rate, reflecting the relative scarcity of labor. Capital growth slows down as the rental rate approaches the subjective rate of time preference (ρ). Given that we have abstracted from exogenous technological progress and autonomous population growth, the steady state is characterized by zero economic growth.

Figure 5 graphs various quantities and rates during the three phases of the economy's dynamic behavior.

Conclusions and Policy Implications

1. Urban-bias policies accelerate the process of rural-urban migration at the cost of increasing the relative (and absolute) size of the informal sector and, therefore, lengthening the time the purely-urban economy takes to become completely formal. (See Appendix B for a detailed description of the length of transition to complete formality.)

2. In the absence of urban-bias policies and for given minimum legal wage and efficiency of informal capital allocation, the relative size of the informal sector remains constant in the face of

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[23]We can show that at the time the flow of migrants stops, the minimum wage is binding in the sense that it is greater than the unregulated wage for the isolated urban economy. This unregulated wage is given by

$$W_{UNR} = A\alpha\left(\frac{K}{L}\right)^{1-\alpha} = A\alpha\left(\frac{W_R + M - a_0(W)}{a_1(W)}\right)^{1-\alpha}$$

Given that the minimum wage was binding in the presence of a rural sector, we know that $W > W_R + M$. Using this inequality, as well as the expressions for a_0 and a_1 from (23), we find that

$$W_{UNR} < A\alpha\left(\frac{W - a_0}{a_1}\right)^{1-\alpha} = W$$

capital accumulation. This is so because the urban labor force grows (through immigration) at the same rate as capital does to maintain the expected equality of wages across urban and rural areas.

3. When the minimum legal wage is increased, the capital growth rate falls, inducing a decrease in the growth rate of the urban labor force. A rise in the minimum legal wage delays the time to complete the rural-urban migration process and slows down the transition to a purely formal economy.

4. When the efficiency of informal capital allocation improves (γ increases), the process of rural-urban migration is completed faster but at the cost of delaying the next stage, in which the formal economy expands. This is so because an improvement of informal capital allocation induces informality. Nevertheless, as concluded in previous sections, a rise in γ brings the informal wage closer to the formal one.

IV. EXTENSIONS FOR FUTURE RESEARCH

We believe that the theoretical analysis in this paper should be extended along the following two directions. The first one is to examine the welfare implications of informal economies and, therefore, the welfare effects of our various policy parameters. This could be done using the approach outlined by Sen (1974), which considers not only the average level of income but also a measure of inequality. The second extension is to allow for endogenous determination of the minimum legal wage through the formation of coalitions. If the minimum legal wage is updated to satisfy some collective purpose, there exists the possibility of partial economic informality in the long run.

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Table 1 Rough Estimates of the Informal Sector Labor Force in Urban Areas

Country Category	GDP per Capita (1985 PPPs) US$	No. of Countries	Informal Sector (%)
Low Income	Under 1,000	4	51
Mid. Range (I)	1,000-1,500	5	47
Mid. Range (II)	1,500-2,000	2	43
Mid Range (III)	2,000-3,000	4	35
High Income	3,000 and above	4	31

Note: Low Income Countries: Nigeria, Bangladesh, India, Cote d'Ivoire.
Mid. Range (I) Countries: Pakistan, Bolivia, Indonesia, Philippines, Morocco.
Mid. Range (II) Countries: Sri Lanka, Thailand.
Mid. Range (III) Countries: Peru, Colombia, Turkey, Costa Rica.
High Income Countries: Korea, Brazil, Chile, Venezuela.

Source: Turnham (1993), p. 147. Estimates based on Labor Force Survey data: Informal sector employment is proxied by the sum of the self-employed -except professionals and technicians-, their unpaid family workers, and wage workers in "small" enterprises. Real GDP per capita, from Summers and Heston (1988).

Table 2 Demographic Indicators and Investment Rates in Latin America

Country	Average Annual Growth Rate from 1950 to 1990 of the		Urban Population as Percentage of the Total in 1950 and 1990	Average Ratio of Investment[b] to GDP from 1950 to 1985
	Total Population	Urban Population		
Argentina	1.5	2.3	66.1 - 86.2	25.1
Bolivia	2.4	3.2	38.2 - 51.4	12.9
Brazil	2.6	4.4	36.4 - 76.9	24.4
Chile	1.9	2.9	60.2 - 85.6	29.7
Colombia	2.6	4.1	37.9 - 70.3	18.8
Costa Rica	3.2	4.0	33.9 - 53.6	14.2
Ecuador	2.9	4.5	29.2 - 56.9	24.1
El Salvador	2.5	3.0	36.8 - 44.4	7.3
Guatemala	2.9	3.2	33.0 - 42.0	8.8
Mexico	2.9	4.2	43.5 - 72.6	18.8
Panama	2.7	3.5	37.4 - 54.8	23.0
Peru	2.6	4.3	35.4 - 70.2	13.2
Uruguay	0.8	1.0	78.5 - 85.5	12.1
Venezuela	3.4	4.8	53.0 - 90.5	11.7
Latin America	2.5	3.9	41.8 - 71.5	17.4
1950-60	2.8	4.5	49.3[a]	
1960-70	2.7	4.2	57.3[a]	
1970-80	2.6	3.7	65.0[a]	
1980-90	2.1	3.1	71.5[a]	

[a]Figures are for the year ending the decade. [b]Public plus private investment.

Sources: For population data, ECLA (1981), ECLAC (1991), United Nations (1991a, 1991b). For investment data, Summers and Heston (1988).

Table 3 Populist Episodes in Eight Latin American Countries

High Populist Countries	Low Populist Countries
Argentina Perón (1946-55) Perón (1973-76)	Colombia Betancur (1982-86)
Brazil Vargas (1951-54) Goulart (1961-64) Sarney (1985-1990)	Mexico Echeverría (1970-76)
Chile Ibáñez (1952-58) Allende (1970-73)	Venezuela Pérez (1974-78)
Peru Belaunde (1963-68) Velasco (1968-75) García (1985-90)	Uruguay Battle (1954-58)

Source: Kaufman and Stallings (1991), p. 29.

Table 4 Latin America: Rough Estimates of Urban Informal Employment as a Percentage of the Urban Labor Force, 1960-89

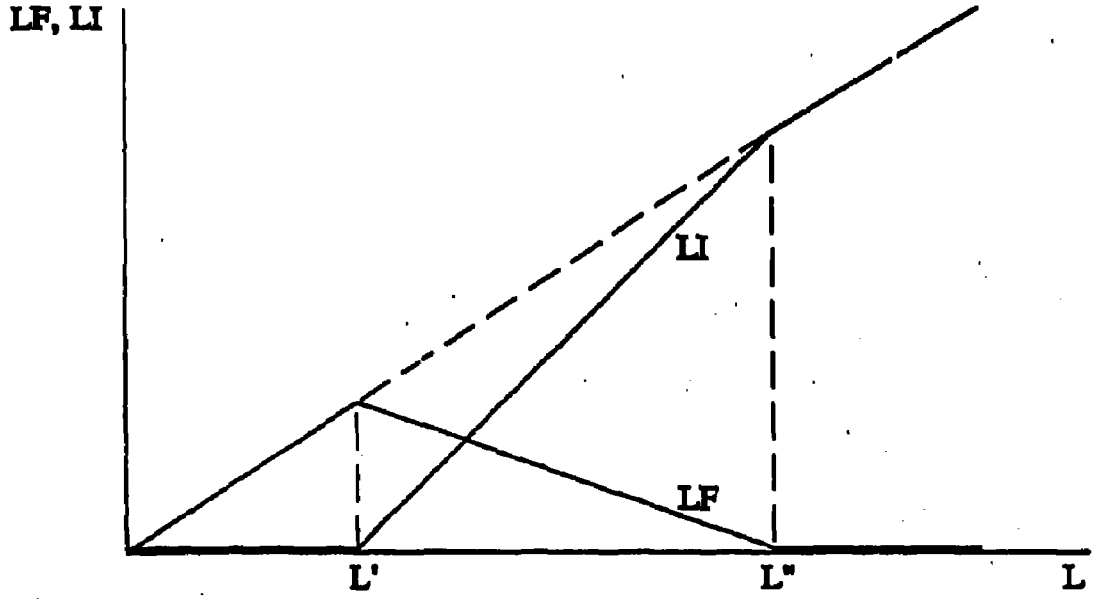
Country	1960	1970	1980	1989
Argentina	21.1	19.1	23.0	28.7
Bolivia	62.2	56.0	56.5	n.a.
Brazil	27.3	27.9	27.2	28.6
Chile	35.1	23.9	27.1	30.0
Colombia	39.0	31.4	34.4	27.3
Costa Rica	29.3	22.6	19.9	22.0
Ecuador	35.2	58.0	52.8	n.a.
El Salvador	42.6	39.5	39.9	n.a.
Guatemala	51.6	43.5	40.0	n.a.
Mexico	37.4	34.9	35.8	34.8
Panama	25.3	26.5	35.6	n.a.
Peru	46.9	41.0	40.5	39.0
Uruguay	18.6	20.7	23.1	19.0
Venezuela	32.3	31.4	20.8	23.3
Latin America	30.8	29.6	30.2	31.0

Note: PREALC has consistently classified the self-employed -excluding professionals and technicians- and their unremunerated family workers as informal workers. Domestic servants were similarly so classified in earlier estimates. Owners and salaried workers in "small" enterprises are classified as informal workers only in the estimates for the year 1989.

Source: Portes and Schauffler (1993), p.42. Estimates obtained from various publications by ILO's Regional Employment Program for Latin America and the Caribbean (PREALC).

FIGURE 1

Given W, GAMMA and, as appropriate, K or L



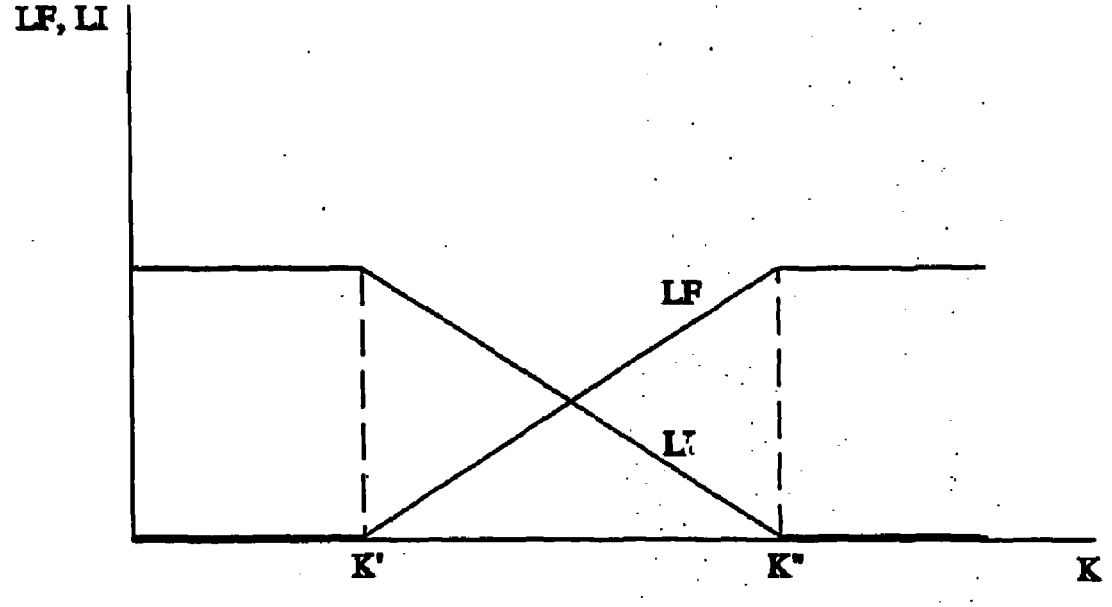


FIGURE 2

Given K/L and GAMMA

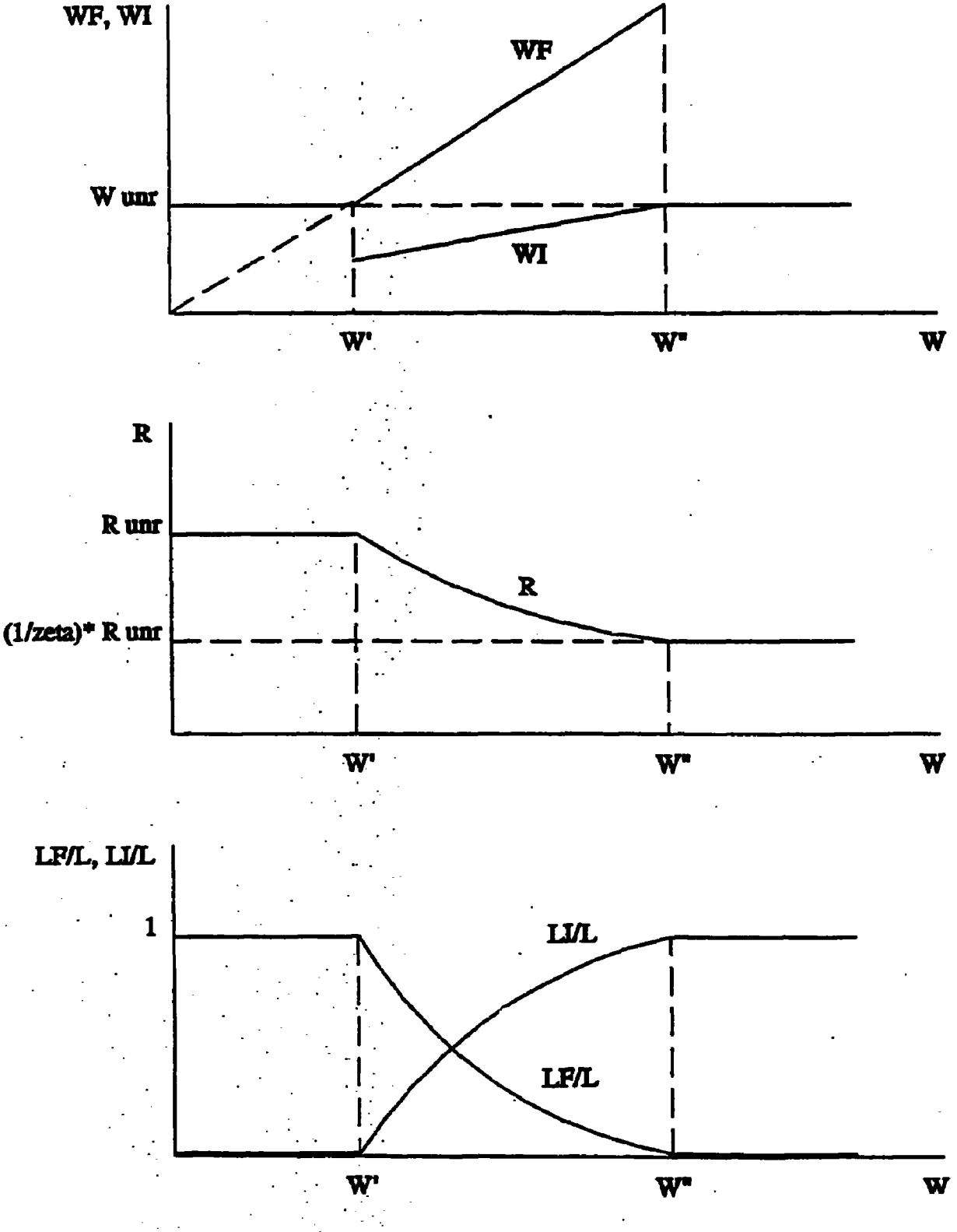


FIGURE 3

Given K/L and a binding W

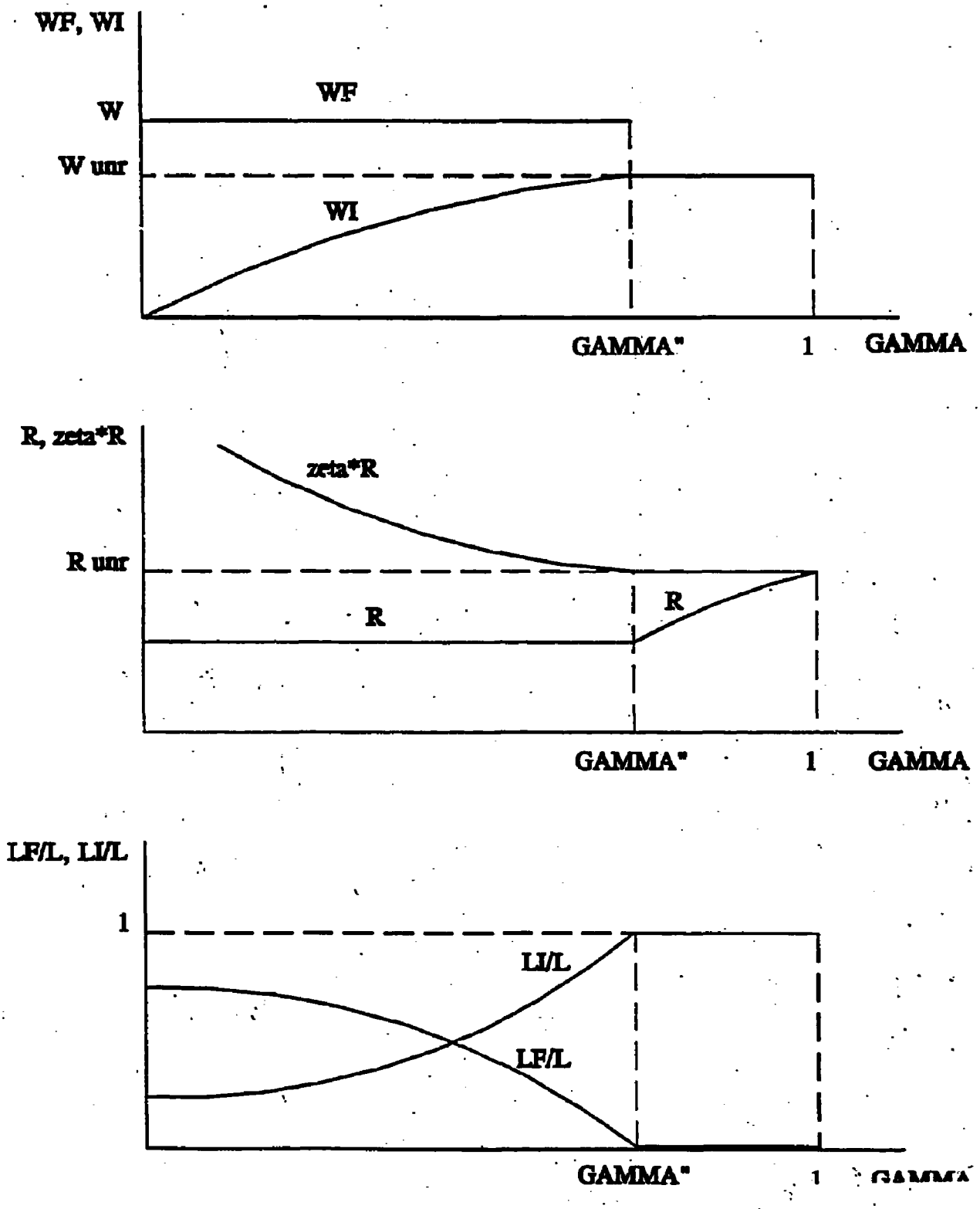
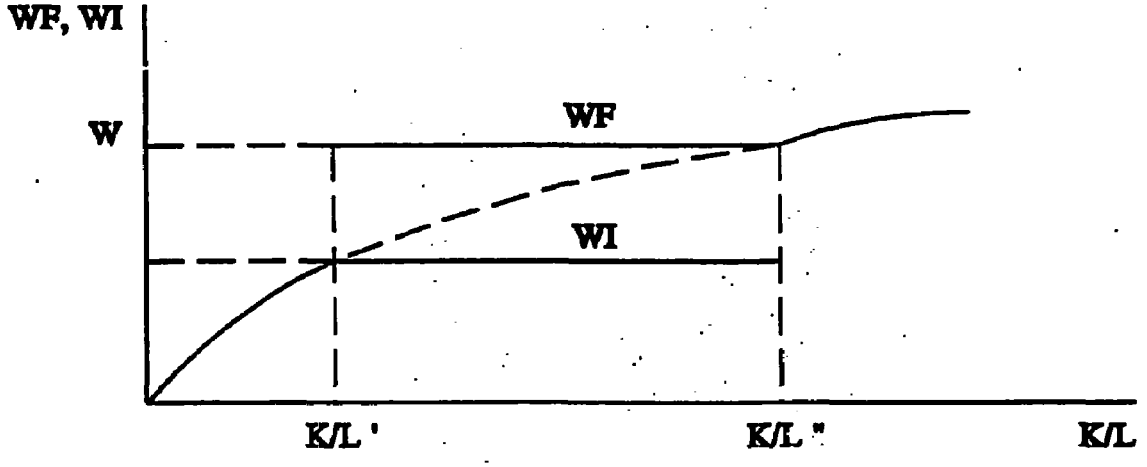
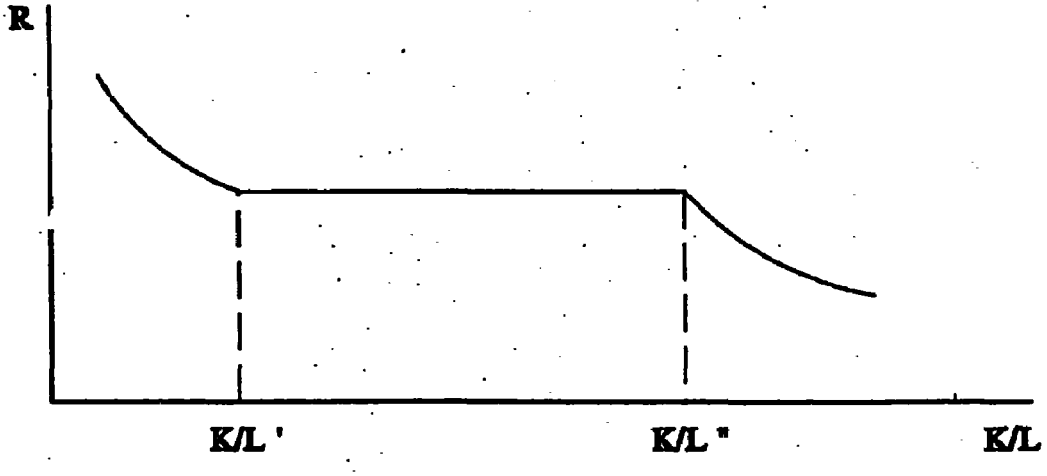


FIGURE 4

Given W and GAMMA





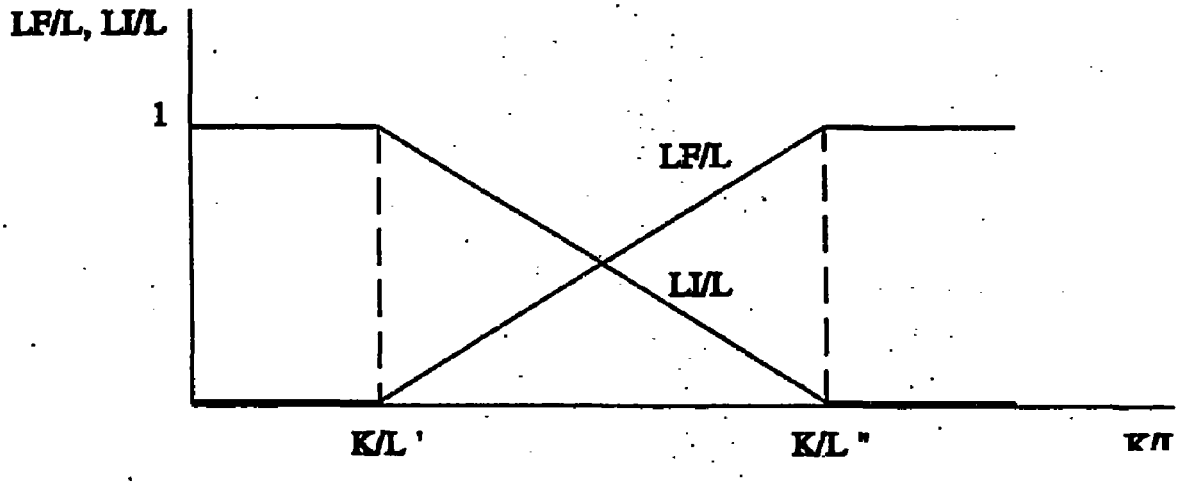
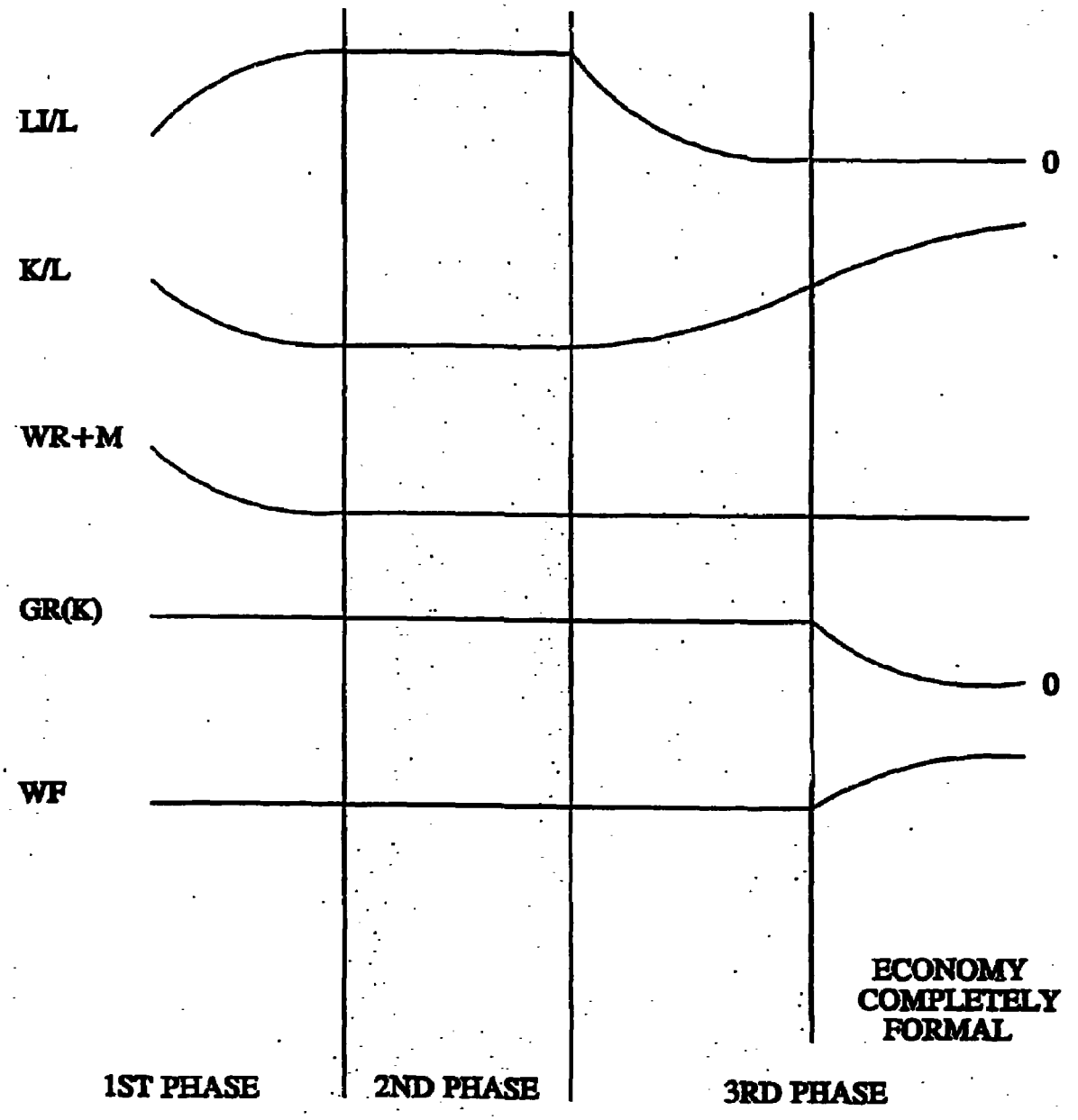


FIGURE 5


LI/L
0
K/L
WR+M
GR(K)
0
WF
ECONOMY
COMPLETELY
FORMAL
1ST PHASE
2ND PHASE
3RD PHASE

APPENDIX A: Partial Job Turnover in the Formal Sector

We can relax the assumption of complete job turnover in the formal sector in the following way: Suppose that at any point in time the fraction θ of formal jobs is allocated to urban workers searching for employment in the formal sector. If $\theta=1$, there is complete job turnover, which is the case presented in the text. If $0<\theta<1$, formal workers have a better chance to retain their higher-paying jobs than the rest of the urban labor force.

Under this new job-allocation arrangement, the expected urban wage for people searching employment in the formal sector is given by

$$W_E = \frac{\theta L_F}{\theta L_F + L_I} W + \frac{L_I}{\theta L_F + L_I} W_I \qquad (23')$$

Using the migration equilibrium condition (equation (22)), we obtain an expression for the size of the urban labor force at any point in time,

$$L = h(W_R + M, W, \gamma, \theta) K \qquad (24')$$

The effects of the capital stock and the parameters on the urban labor force are the same as those under complete job turnover. In particular, the urban labor force is linearly increasing in the capital stock, increasing in the efficiency of informal capital allocation (γ), and decreasing in the adjusted rural wage (W_R+M). It is also straightforward to show that the size of the urban labor force varies directly with the fraction θ. That is, as a greater fraction of formal jobs become open, more people migrate to the cities in search for a higher-paying formal job. In equilibrium, of course, the informal sector expands so as to equalize the expected urban wage to the adjusted rural wage.

From the migration equilibrium condition, we can also obtain the relative size of each sector as a function of θ and the other parameters. As we said before, if $\theta=1$, there is complete job turnover and the expressions for L_F/L and L_I/L given in the text (equation (25)) hold true. Let us denote the relative size of formal and informal sectors when $\theta=1$ as $L_F/L(1)$ and $L_I/L(1)$, respectively. After some manipulation, we obtain

$$\frac{L_F}{L}(\theta) = \frac{\frac{L_F}{L}(1)}{\frac{L_F}{L}(1) + \theta\left(1 - \frac{L_F}{L}(1)\right)}$$

$$\frac{L_I}{L}(\theta) = \frac{\theta\frac{L_I}{L}(1)}{1 - (1-\theta)\frac{L_I}{L}(\theta)} \qquad (25')$$

As with complete job turnover, the relative size of the informal sector increases with the minimum legal wage (W) and the efficiency of informal capital allocation (γ), and decreases with the adjusted rural wage (W_R+M). Furthermore, under partial job turnover, the relative size of the informal sector varies directly with the fraction of formal jobs open to those searching for employment in this sector (θ).

APPENDIX B: Length of Transition to Complete Urbanization and Formality

The urban labor force is given by,

$$\begin{aligned} L(t) &= L(0)e^{(R_0-\rho)t+\int_0^t \phi(v)dv} && for \quad 0 \le t < T_1 \\ L(t) &= L(T_1)e^{(R_0-\rho)(t-T_1)} && for \quad T_1 \le t < T_2 \\ L(t) &= L^* && for \quad T_2 \le t < \infty \end{aligned} \tag{B1}$$

where L^* is the constant labor force in the country (rural plus urban). Clearly, T_1 is the time at which urban-bias policies level off, and T_2 marks the time when rural population disappears.

The stock of capital is given by,

$$\begin{aligned} K(t) &= K(0)e^{(R_0-\rho)t} && for \quad 0 \le t < T_3 \\ K(t) &= K(T_3)e^{\int_{T_3}^{-} (R_{UNR}(v)-\rho)dv} && for \quad T_3 \le t < \infty \end{aligned} \tag{B2}$$

where $K(T_3)$ is such that

$$W = A\alpha\left(\frac{K(T_3)}{L^*}\right)^{1-\alpha} \tag{B3}$$

Clearly, T_3 is the time at which the economy becomes completely formal.

Urban-bias policies ($\phi(v)>0$) diminish T_2 but do not affect T_3, which depends on the initial level of the capital stock (which is given) and its rate of accumulation.

An increase in the minimum wage makes T_3 rise because W both decreases R_0 and increases $K(T_3)$. If total labor force in the country is large enough, T_2 will also vary directly with W: We know that $L(T_2) = L^*$, then, from (B1),

$$L^* = L(0)e^{(R_0-\rho)T_2+\int_0^{T_1}\phi(v)dv} \tag{B4}$$

therefore,

$$\frac{\partial T_2}{\partial W} = \frac{-1}{(R_0-\rho)^2}\left[\ln\left(\frac{L^*}{L(0)}\right)\frac{\partial R_0}{\partial W} + \frac{R_0-\rho}{L}\frac{\partial L(0)}{\partial W}\right] \tag{B5}$$

The partial derivative of L(0) with respect to W could be positive or negative; but if L^* is large enough, which we assume, the sign of the expression in brackets is negative. Then, T_2 varies directly with W.

An improvement in the efficiency of informal capital allocation lowers T_2 because it rises the initial level of the urban labor force (L(0)). However, it does not affect T_3.

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